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GARDENING AT INUVIK

R. E. HARRIS

Reprinted from "CANADA AGRICULTURE" Winter, 1969

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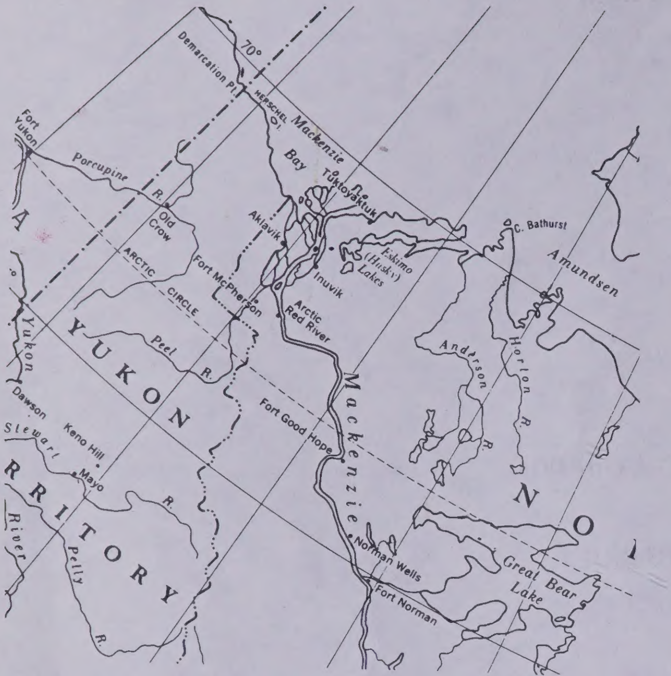


Gardening at INUVIK

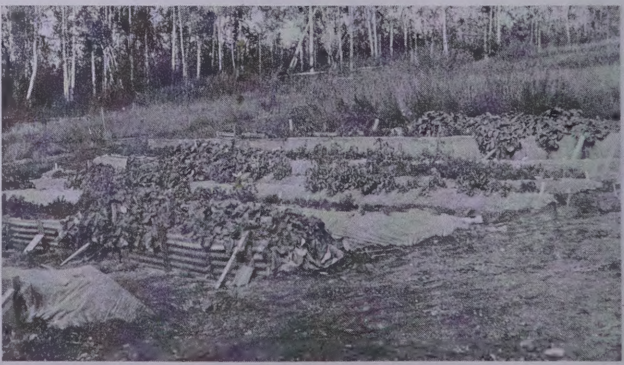
R. E. HARRIS

Gardening in the Canadian Arctic and Sub-Arctic is not new. As early as 1789, Alexander Mackenzie, on his way to explore the river that now bears his name, wrote of the excellent garden at the mouth of the Athabasca River, grown by Peter Pond, a fur trader. The late Dr. Albright, then Superintendent of the Experimental Sub-Station at Beaverlodge, visited some 15 gardens along the Mackenzie River in 1930, three of them north of the Arctic Circle. According to his reports all were excellent. The gardens were on light textured soils that thawed-out and warmed up quickly in the spring.

Since over 75% of the land area of Canada has a polar or sub-polar climate, there are many areas where a short season and cool soil greatly restrict the number of vegetables that can be grown without special cultural treatment. In the far north, where the soil is permanently frozen in its native state, this situation exists in the extreme.

The Inuvik town site (68°N) near the mouth of the Mackenzie River, 127 miles north of the Arctic Circle, is located on permafrost. Yet, with good cultural practices, many types of vegetables grow during the long days of Inuvik's brief summer. When planning the town site the Department of Northern and Indian Affairs set aside areas for gardens. This was done in an attempt to encourage the inhabitants of the north to improve their standard of living, and reduce their cost of living by growing some of their own food.

To solve some of the problems associated with gardening on permafrost the CDA Research Branch established a one-acre test site in the garden area of Inuvik in 1956. The research was under the supervision of the Experimental Farm at Fort Simpson until 1964. Since then research has been directed by the Beaverlodge Research Station.



Vegetables growing in ridges and terraces in C.D.A. garden. Note natural windbreak in background.

The site, in the Mackenzie delta, is not the best location for gardening. Some of the delta land along the river is undoubtedly better, but this land is not easily reached from the town. The unfavorable nature of the site guarantees that if you can produce vegetables here, then there are a great many locations throughout the north where vegetables could be

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Dr. Harris is Head, Cereal, Oilseed, Fruit and Vegetable Section, CDA Research Station, Beaverlodge, Alta.

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grown. Many of the techniques developed through research at this site will be generally useful in areas where cool soils limit plant growth.

The site at Inuvik is on the southwest slope of a small ridge. Natural cover was 20-ft. high aspen poplar interspersed with spruce and birch, and dwarf shrubs. These were growing on 8 to 14 inches of moss and partially decomposed organic matter overlying 4 to 6 inches of gravelly loam, overlying clay. Under natural vegetation only the top 15 inches of cover normally thawed during the summer. After the land was cleared and broken, thawing increased each year reaching a maximum depth of 7 ft. after 8 years.

The one-acre site was cleared of plant growth and 6 to 8 inches of the undecomposed organic matter in 1956. The remaining soil had a pH of 6.4, conductivity of 0.8 mmhos, no nitrates or sulphates, 3.2 lbs of phosphorus per acre, a trace of potassium and 130 ppm. of calcium. The temperature of the cleared soil at 4 inches in late May is about 35°F, increasing to 45° by mid-June, 57° by mid-July and 60° by mid-August. The growing season at the Inuvik site is approximately 90 days with 900 degree days over 42°F. The frost-free period is approximately 52 days, killing-frost-free period 80 days, and mean July temperature 55°F.

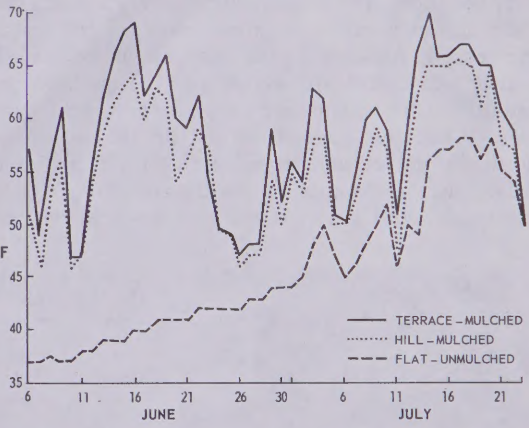
During the first few years vegetable production on the site was disappointing. However, each year further knowledge obtained was used to improve the management for the following year. Field tests to determine the nutrient requirements of the soil were inconclusive, but greenhouse tests showed nitrogen, phosphorus, potash and sulfur to be lacking in the virgin soil. Using Comet radish as the indicator crop, it was found that the addition of all four elements to the 0 to 6 inch layer of soil increased yield by 150%, and to the 6 to 12 inch layer by over 700%. Additions of calcium, magnesium and the micronutrients did not increase yield. After 9 years under cultivation no response was obtained from sulfur in greenhouse tests but good response was obtained from additions of nitrogen phosphorus and potassium. As a consequence, 300 to 400 lbs per acre of 13-13-13 fertilizer was applied during 1966 and 1967 and this, together with improved knowledge of culture, produced the yields shown in Table 1.

Because of the short season, early seeding is essential for most vegetables. To allow early seeding the land is prepared the previous fall by removing the remains of the summer's crop, applying fertilizer and plowing or digging, leaving the surface as rough as possible. Also, if ridging and terracing is being used, it is completed before freeze-up.

We obtained better production of cabbage, cauliflower, kale, broccoli and head lettuce when the seed was pre-sprouted in the greenhouse in late April and pricked out into peat pots or plant bands. The plants were hardened off and planted in the field between June 6 and 15. Radish, leaf lettuce, beet, swiss chard and summer turnip were pre-sprouted and seeded directly into the field as soon as possible in June. This was often done standing on boards, to prevent sinking into the mud. With radish, leaf lettuce and turnip, we had a continual supply by planting every 10 days, up to the end of June, or early July.

Other vegetables did not mature properly unless the soil temperature was increased. Three or four-foot wide clear polyethylene mulches were most effective in doing this. They increased the maximum soil temperatures by as much as 12°F and mean soil temperatures by 5°F. Planting on hills or terraces and mulching with clear polyethylene increased maximum soil temperature by up to 16°F. The increases were greatest during the early part of the growing season.

Clear polyethylene mulches placed flat on the ground increased yields of beet, swiss chard, lettuce and pea. Carrot, rutabaga and potatoes only produced satisfactory crops when grown in 12-inch high ridges or 14-inch high terraces covered with a clear polyethylene mulch.



Soil temperatures at 4 inches taken at 8 a.m. June 6 to July 24, 1967. Soil warm-up was below average in June.

In addition to vegetables, many flowers and some perennials can be grown successfully. Carpet of Snow and Rosie O'Day Alyssum, Double Mission Bells *Eschscholtzia* and Copenhagen Market *Gypsophila* are the best annuals for direct seeding; Pacific Beauty *Calendula*, Double Gaiety *Dianthus*, *Dimorphotheca*, Petite and Choice Double *Tagetes*, *Mathiola bicornis* and single *Petunia* are the best for transplanting.

Delphinium, native *Lupinus*, *Arabis alpinus* vars. Nana Compacta and Snowcap, *Pentemon,* and *Achilea Ptarmica* var. The Pearl are the best perennials followed by *Gypsophila rosea,* Blue Gem *Nemesia*, *Anemone multifida* and *Linum grandiflorum*.

Strawberries, rhubarb, chives and perennial onions are the most reliable of the perennial food crops. They must be fertilized with a 13-13-13 fertilizer every year, cultivated early in the spring and again

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as frequently as possible to loosen and help warm the soil. Bonanza, Northerner and Protem strawberries and MacDonald rhubarb were the most promising varieties tested.

We, of the Research Branch, are not the only ones concerned with the production of vegetables at Inuvik. At about the same time as our plots were established, Father Adam, an experienced northern gardener, started a garden on the edge of the school grounds. He is using different methods and his garden also grows well. He first cleared the site of trees and shrubs and thoroughly broke up the layer of undecomposed organic matter. On top of this he added 14 inches of topsoil. A low board fence was placed on the windward side and good air drainage provided by leaving the opposite side opening into a shallow gulley. He constructed cold frames, 6 ft. wide by 30 ft. long and 10 inches high, with removable sashes covered with polyethylene. The frames are set on the ground and allowed to fill with snow. In early spring the sashes are put on the frames over the snow. The snow melts, the water soaks into the soil and watering is unnecessary for the rest of the season. As soon as the snow is melted, radish, lettuce and carrot are seeded and the cabbage and cauliflower transplants are put in for later field plantings. When the weather warms up the sashes are gradually moved and stored out of the sun. Father Adam uses old paper or plastic cups to grow his transplants and grows them in a window, whereas the C.D.A. uses peat pots or plant bands for growing the transplants in glass, or plastic covered greenhouses.

Due to the cost of hauling topsoil and building cold frames and sashes it costs more to start a garden using Father Adam's method. However, the improvements are more or less permanent, subsequent costs are small, and the frames can be used to grow early crops. Our initial costs involve only clearing of the land and preparing the seed bed and this is all that is required for some crops. However, if mulches and terraces are required they add to the costs as the mulches have to be replaced every year.

Because of the wide differences in methods of growing the plants and in the location of the sites, the growth and yield responses between the two methods cannot be compared. Nor should they really be compared, for they both provide an ample quantity of fresh vegetables for the table.

Many problems associated with gardening on permafrost remain, but enough has been done to show that many common vegetables can be grown under northern conditions. We have no doubt that further improvement in the techniques will result in higher yields and the production of a wider range of crops. Most of these will come about through the efforts of permanent residents like Father Adam. We sincerely hope the research that we have undertaken on permafrost at Inuvik will form the basis for this continuing and expanding production. ■

Vegetables grown on permafrost.

Top row: Left to Right. Lucullus chard, Copenhagen Early Market cabbage, Black Simpson lettuce.

2nd row: Ruby Queen beets, Scotch Curled kale, French Breakfast radish.

3rd row: Scarlet Nantes Coreless carrots, Super Snowball cauliflower, Italian Sprouting broccoli.

Bottom row: Victory Neckless rutabaga, Warba potatoes, Purple Top Milan turnip.

TABLE 1. SOME YIELDS OF VEGETABLES OBTAINED OVER PERMAFROST AT INUVIK, N.W.T.

		Spacing			
Vegetable	Variety	Row	Plant	Yield in cwt/acre	Remarks
		ft.	inches		
Radish	Comet	2	2	27.95	Flat, unmulched
Lettuce	Black Seeded Simpson	2	8	70.18	" "
Turnip	Purple top Mulan	2	4	185.13	" "
Beets	Ruby Queen	2	3	126.11	Hill, mulched 9 days earlier
		2	3	74.81	Flat, mulched
		2	3	57.50	" unmulched
Cabbage	Copenhagen Market Early	3	18	27.31	" "
Broccoli	Italian Sprouting	3	18	1.47	" "
Cauliflower	Stokes Super Snowball	3	18	8.09	" "
Kale	Green Scotch Curled	3	18	4.43	" "
Swiss Chard	Lucullus	3	12	7.58	" "
Peas	Alaska	3	—	13.64	" "
Rutabaga	Victory Neckless	4	4	97.87	Terraced, mulched
Carrot	Scarlet Nantes Coreless	4	2	10.89	" "
Potatoes	Warba	4	12	130.68	14 in. terraced, mulched
		4	12	81.78	12 in. hill, mulched
		4	12	68.41	8 in. hill, "